diffusion studies updates

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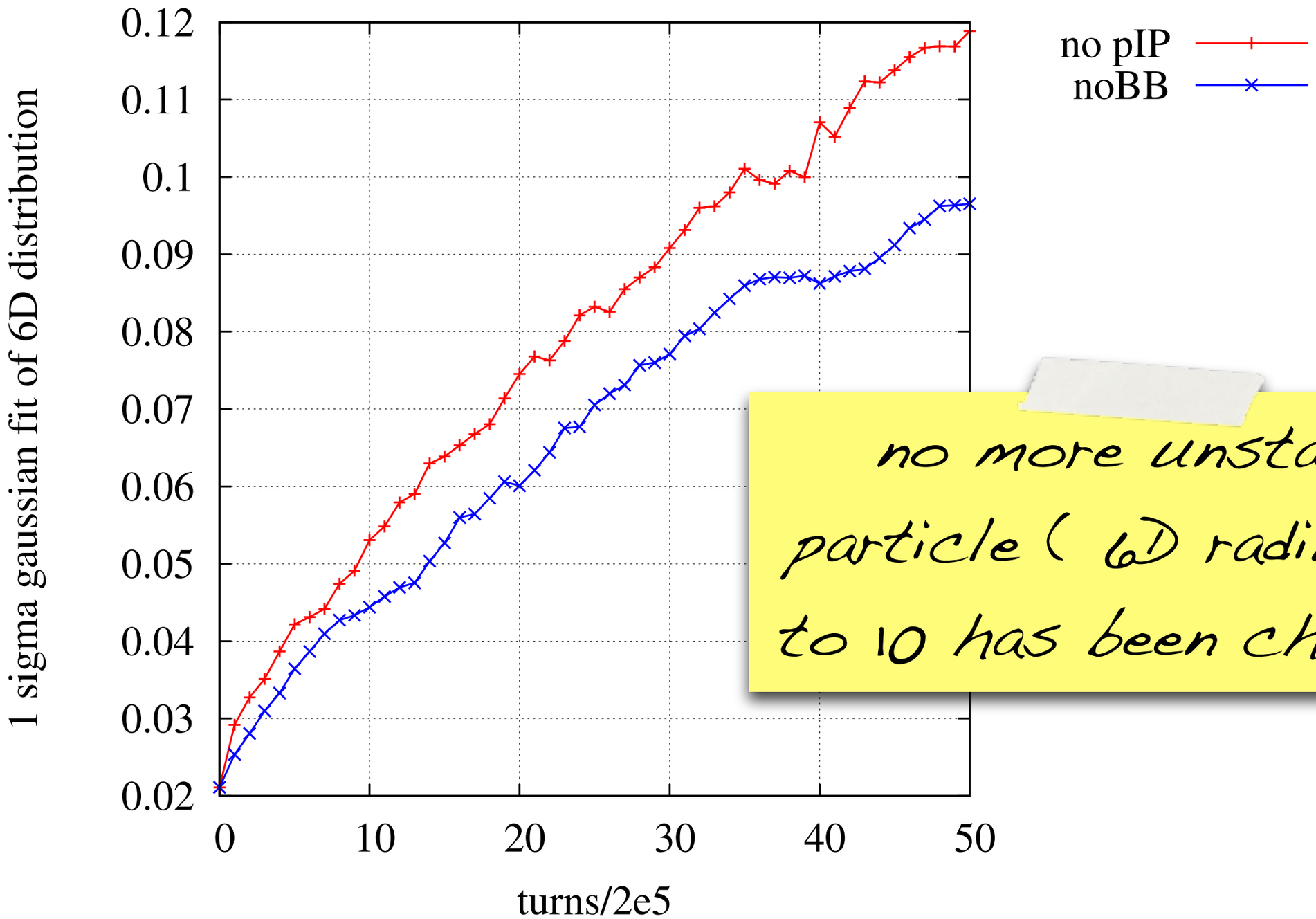
simulation specs

- 1000 particles, 50 steps of 200,000 each
- corresponding to 3 min and 40 sec, data every 4.4 s
- simulated 2,3 .. 10 sigma with and without BB (total of 18 cases)
- aperture is set at 100 sigma
- collimators and apertures have been removed from the sequence
- histograms have been enabled
- computational time ~3h20min
- output data ~7.4 Mb

from last meeting: unstable high amplitude particles

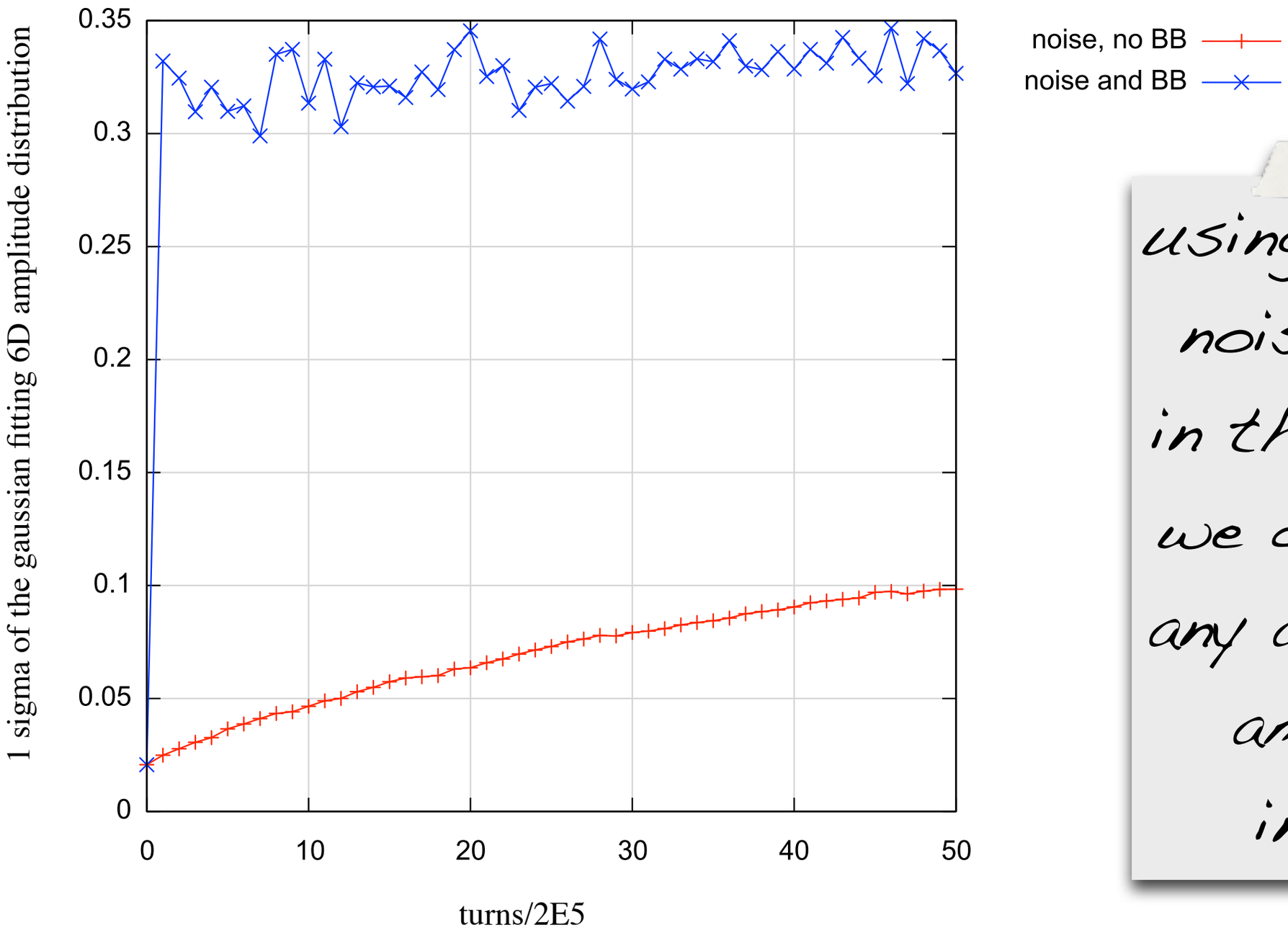
- When switching BB on, in case of 6d normalized radius>8, a large number of particles is unstable
- Removing parassitic IPs to see if these are responsible for the instability

no more "jump" in amplitude at the fist step!



no more unstable particle (6D radius up to 10 has been checked)

from last meeting: no appreciable diffusion for BB particles

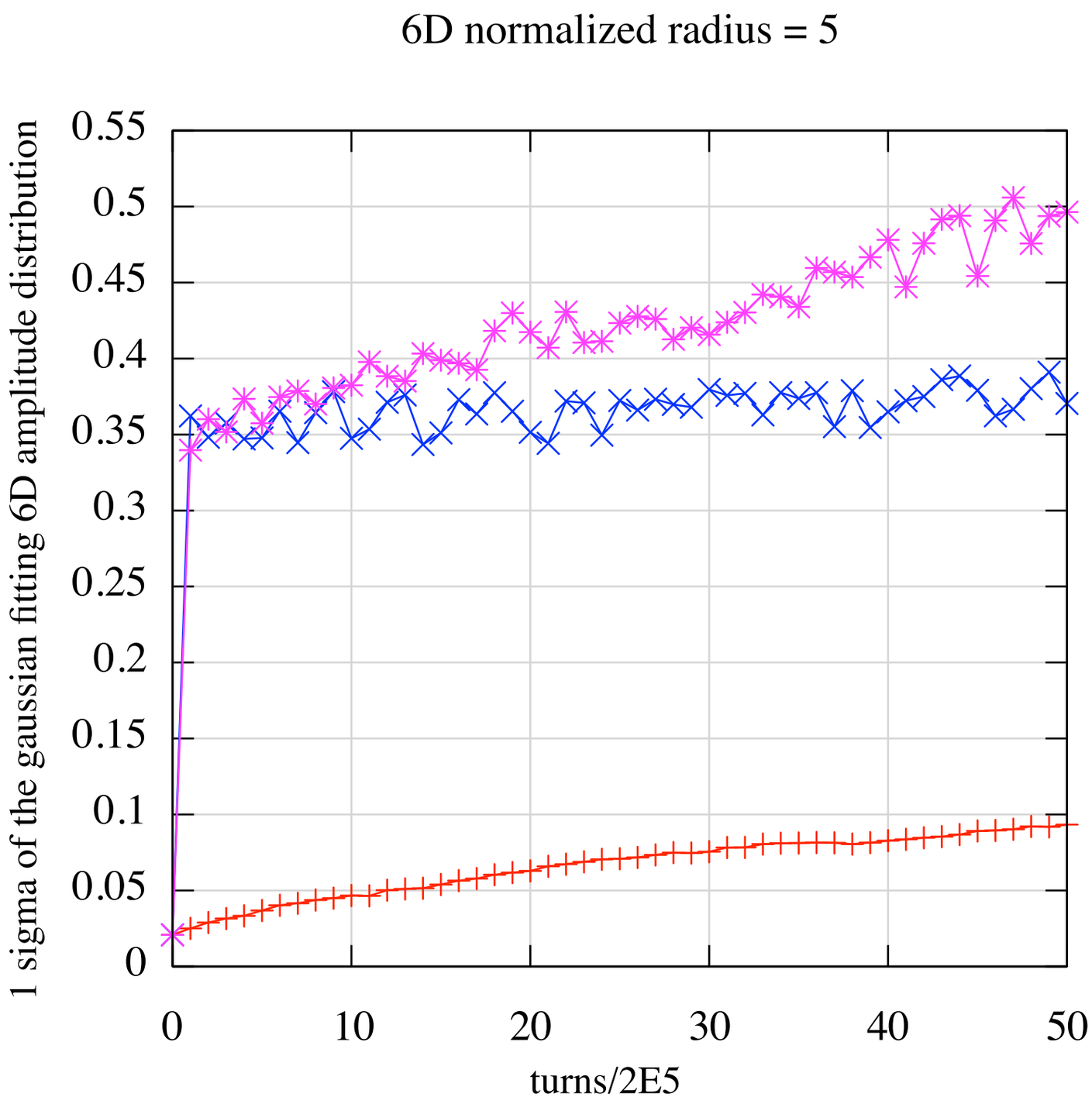


using the same noise matrix, in the BB case we do not see any appreciable amplitude increase

Noise matrix elements have been increased of one order of magnitude (10x)

```
!# Noise_Matr: NOISE
! 8.2E-15  0        0        0        0        0
! 0        6.6E-18  0        0        0        0
! 0        0        4.1E-15  0        0        0
! 0        0        0        3.3E-18  0        0
! 0        0        0        0        0        0
! 0        0        0        0        0        4.5E-17

# Noise_Matr: NOISE
 8.2E-14  0        0        0        0        0
 0        6.6E-17  0        0        0        0
 0        0        4.1E-14  0        0        0
 0        0        0        3.3E-17  0        0
 0        0        0        0        0        0
 0        0        0        0        0        4.5E-16
```



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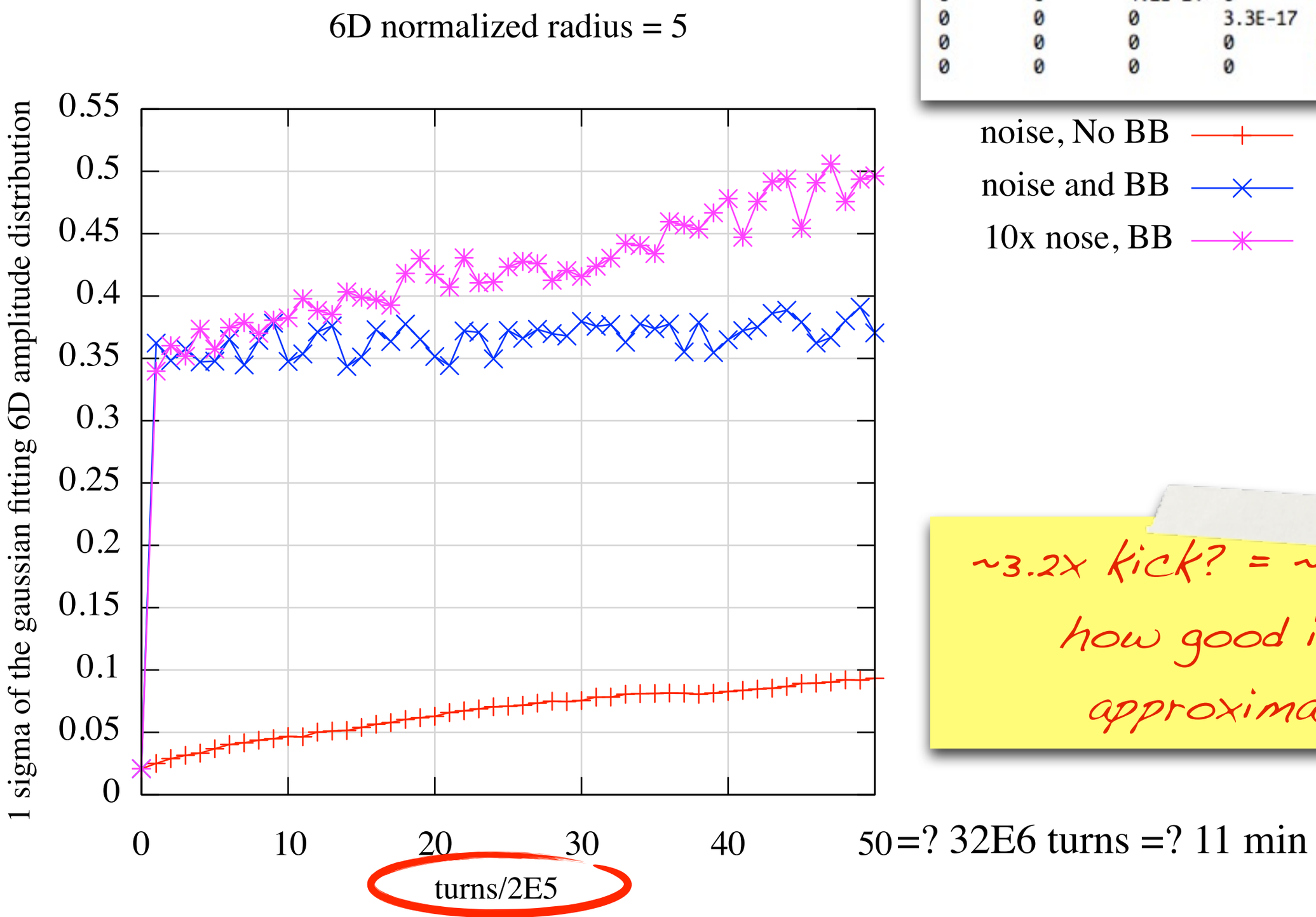
! 8.2E-15  0        0        0        0        0
! 0        6.6E-18  0        0        0        0
! 0        0        4.1E-15  0        0        0
! 0        0        0        3.3E-18  0        0
! 0        0        0        0        0        0
! 0        0        0        0        0        4.5E-17

# Noise_Matr: NOISE
 8.2E-14  0        0        0        0        0
 0        6.6E-17  0        0        0        0
 0        0        4.1E-14  0        0        0
 0        0        0        3.3E-17  0        0
 0        0        0        0        0        0
 0        0        0        0        0        4.5E-16
```



=? 32E6 turns =? 11 min

~3.2x kick? = ~3.2x time?
how good is this approximation?

Which distribution?

- which data should I analyze?
- The quantity which is conserved (in the linear machine) is, obviously, the 6D normalized amplitude.

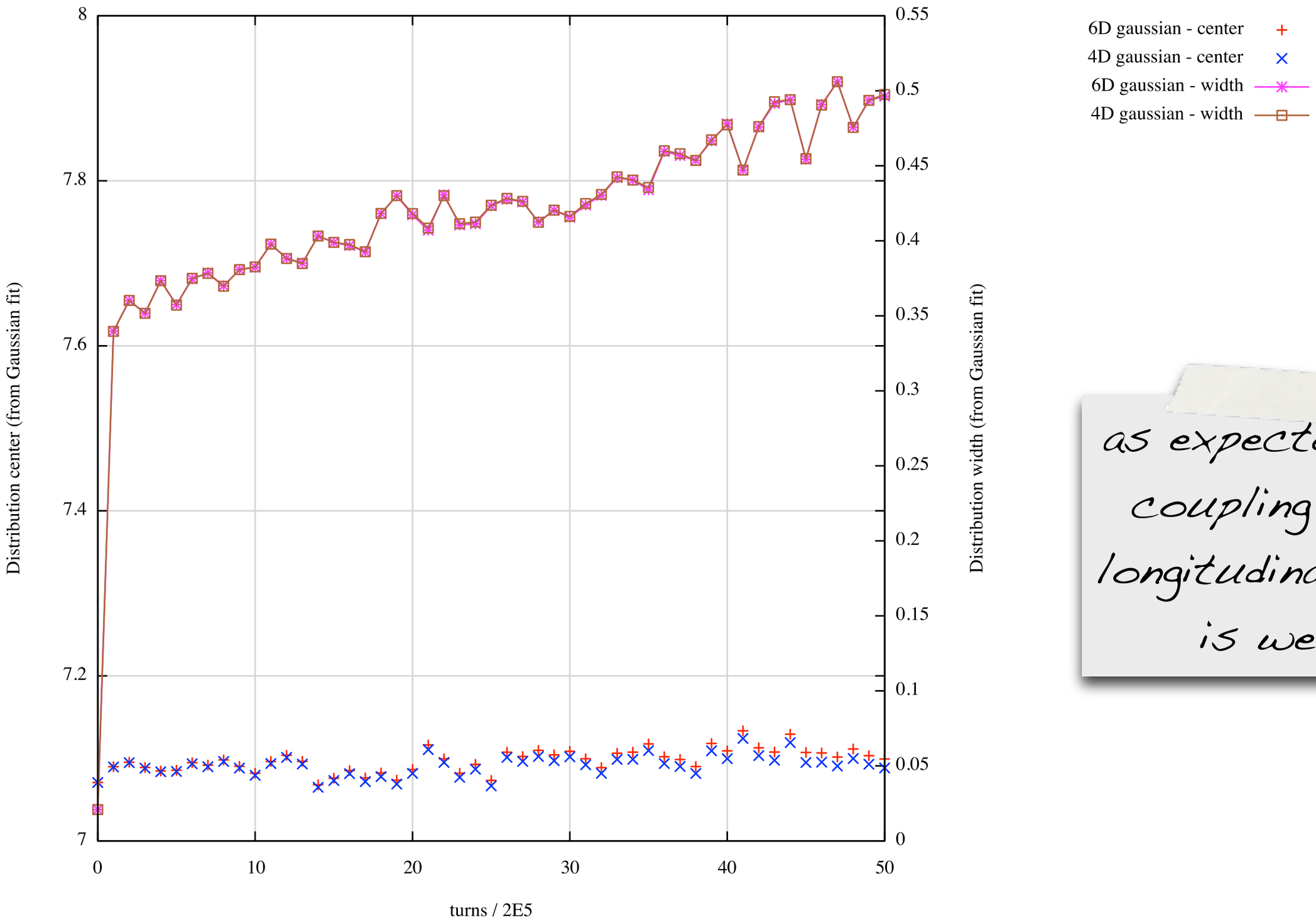
simulations naturally provide 6D amplitudes

- However in the reality I measure in the x-y plane.

measurements of Diffusion coefficient are in the real (not normalized!) x-y space

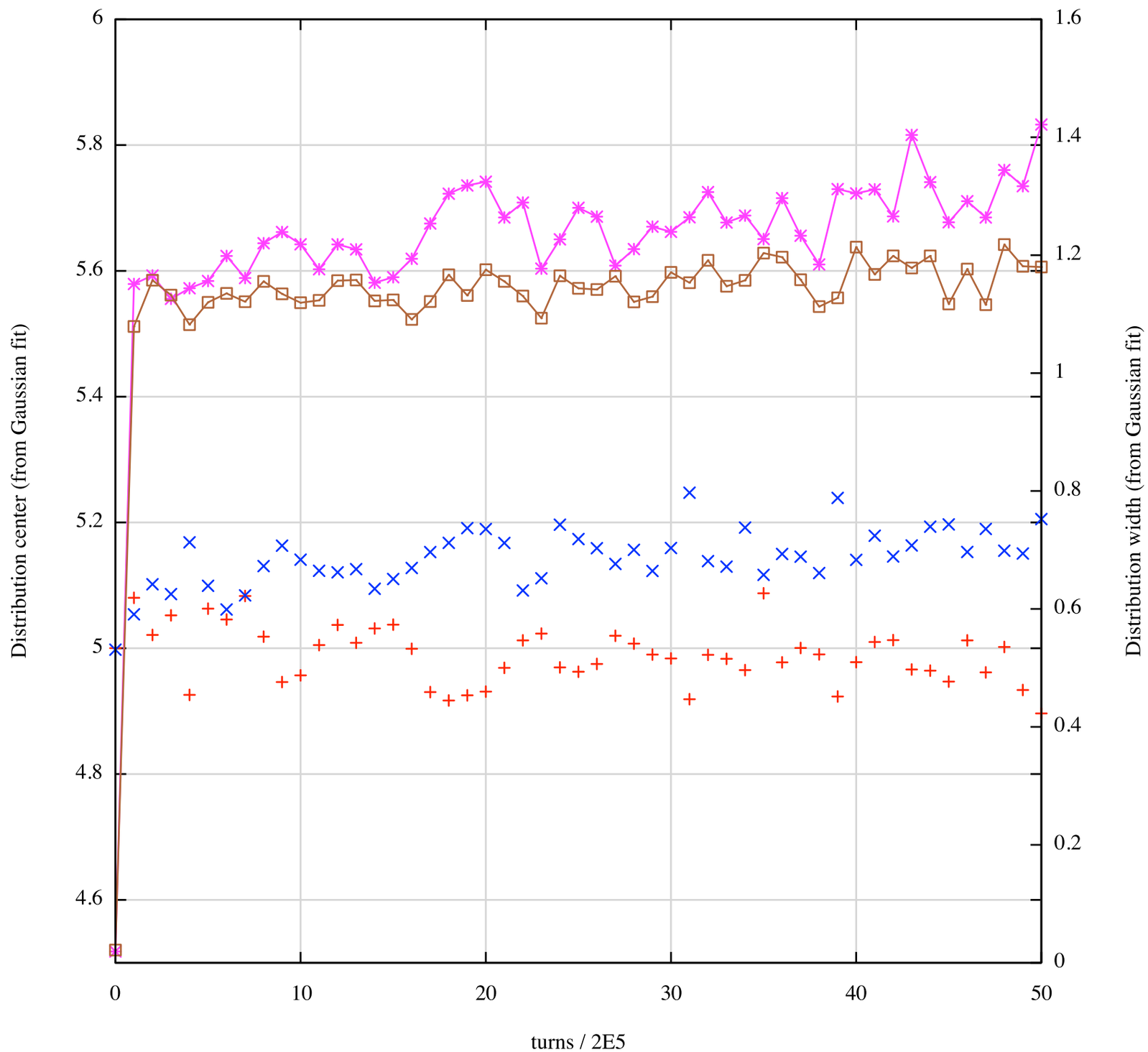
10x noise, BB, 5 sigma case

4D vs 6D distribution



as expected, the coupling with longitudinal plane is weak

comparison of 2D amplitudes



coupling between the 2 transverse planes is not negligible

I maybe should study the Diffusion separately

What are the normalized "x" and "y" planes?

- I can study the evolution of the particle population in the action space separately in the two trasverse planes, however what I call "x" and "y" are in fact SKEW planes (eigenvectors for the one-turn coupled matrix)
- Giulio needs the Diffusion coefficient in [um^2/s] in the action space (2D or 4D, to be understood). To pass from the amplitude radius *n* to the action I need to calculate *(n*emittance)* ^{2}
- I have the normalized distributions in the skew planes, but my input emittances are defined in the physical planes (true?). How do I get the emittance values in the skew planes?